Defense MicroElectronics Activity

DMSMS Tutorial

DMSMS Conference 2002

New Orleans, Louisiana March 25, 2002

Tutorial Outline

- Session 1: The What, Why, and Who of DMSMS
  - What is DMSMS?
  - Why do we care?
  - Who are the players?
- Session 2: How to Manage DMSMS
  - DMSMS Management Styles & Tools
  - Common Practices to Manage DMSMS
  - Resolution Cost Metrics
- Session 3: Current Issues and Topics in DMSMS
  - Miscellaneous Technology Issues

Defense MicroElectronics Activity

DMSMS Tutorial

The What, Why, and Who of DMSMS

(Session 1)

Definitions

(What is DMSMS?)

- What is *Diminishing Manufacturing Sources and Material Shortages (DMSMS)*?
  - (DoD Definition) The loss or impending loss of the ***last known*** manufacturer or supplier of raw material, production parts or repair parts
  - (Industry Definition) The loss or impending loss of the ***original*** manufacturer or supplier of raw material, production parts or repair parts
- *Obsolete Part*: A part of a larger system that is no longer manufactured by the original manufacturer.

Factors Driving Military DMSMS (Why do we care?)

- Prime Driver of DMSMS Situation - *Commercial Profit Motive*: *When a part is no longer economical to produce, manufacturers will move on to more profitable items*.

- The *Commercial Profit Motive* works against the military for two reasons

  - Diminished Overall Demand:
    - Military customers "require" *specialized* parts (i.e., temp, voltage)
    - Commercial microcircuit users (computers, cell phones, etc.) now constitute—by far—the largest share of the market
    - Military share of the microcircuit market:
      1975: 17% 1985: 7% 2002: ~0.1%

  - Extended Support Periods:
    - Microcircuit life cycles average ~18 months (much less for memories)
    - DoD has long design-to-acquisition lead times
    - Extension of the service lives of systems
    - Support requirements for military systems outlast those of parts
      - Commercial electronic systems: 4 – 7 years
      - Military electronic systems: 25 – 30 years

Decreasing Supply Voltage: Issues

- Situation:
  - Because of extended weapon system life cycles, these systems are rooted in high (5V) supply voltage technology
- Problem:
  - Commercial markets driving operating voltages lower than 1.8V
    - 5V to 3V conversion might sometimes work
    - 5V to < 3V conversion = *Incompatibility*
  - Industrial Base capability focuses on the high volume commercial market vice to higher voltage components for military use
  - Low volume military demand is insignificant in the large market for lower voltage devices
- Impact:
  - Potential major efforts required to maintain legacy systems
    - Redesign / Retest On parts substitution
  - Delays and added costs to sustainment programs
  - High potential for unsupportable systems

Decreasing Supply Voltage: Considerations

- Expected diminishing future sources of higher operating voltage Components as market driven demand pushes voltages to lower levels
- Performance issues in products with mixed operating voltage devices or multiple power busses
- Fielded products become unsupportable for lack of component availability
- Need to demonstrate innovative concepts for maintaining legacy products
- New design rules to encourage robustness

Commodities Impacted by DMSMS

- Microelectronics - 83%
- Other - 17%

Bearings
Semiconductors
Switches
Connectors
Equipment
Resistors
Capacitors
Circuit Cards
Modules
Fiber Optics
Tubes
Fire Control
Radar
ADP Equipment
Antennas
Electronic

GIDEP Submittals 1999

Major Microcircuit Problem Areas

- Discrete logic (bipolar & CMOS)
- 5V devices of all types
- Linear bipolar
- Power devices
- Hybrids
- RF circuits
- ASICs (gate arrays & mixed signal)
- Processors & microprocessors
  - Legacy architectures plus “modern” processors
  - Preservation of legacy code investment
- Radiation hardened ICs
  - LEO, MEO, HEO

Where Is IC Technology Headed?

- Dramatic scaling of features and voltages
- Increased speed and functionality
- Shorter commercial product life cycles
- IC design more application focused
- Escalating cost of resources
- More suppliers contracting fab and assembly
- Computers, communications and consumers drive the market

-- Military/Aerospace Division National Semiconductor -1997

Microcircuit Life Cycles & Introduction Rates

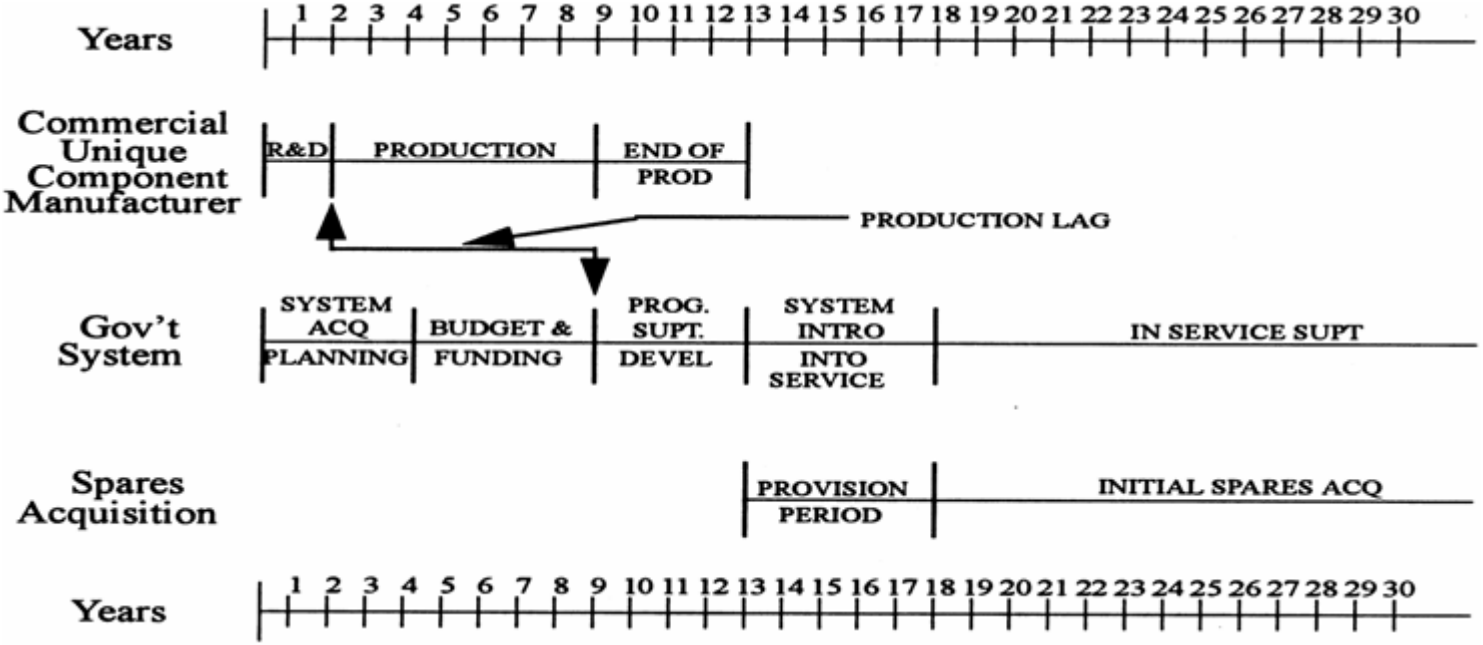
Average Microcircuit Life Span	
Total (all quality ranges)	10 years
Military	> 12.5 years
Commercial	< 8.5 years
Certain Linear	< 14.5 years
Some uP, memories	< 5 years

Device Category	Average Introduction Rate
Logic Families	6 years
Memory Families	9 months
Microprocessors	2 years
DSP	3 years
PLD	1 year
Linear Interfaces	8 years
Gate Arrays	2 years

Bick, E. (TACTech Inc.). "New & Improved Life Cycle Codes Updates - Response To AIM Users Regarding The New & Improved LCCs." ebick@tactech.com (20 Jul. 1999).

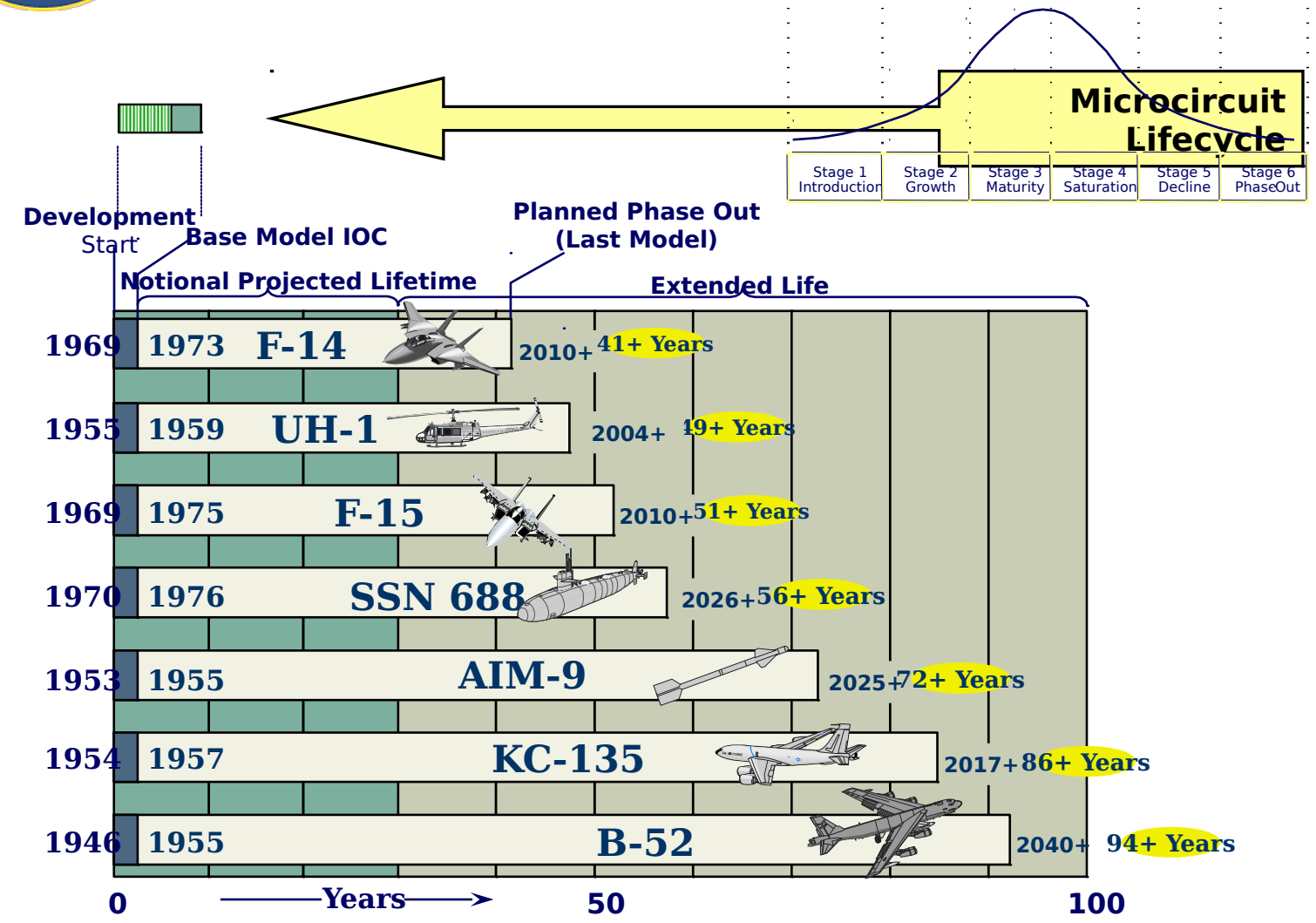
TACTech Inc. "Obsolescence Management In the Year 2000." 28 Oct. 1998. ftp://tactech.com/pub/overview.exe (14 Jun. 2000).

Defense Acquisition Time-Line


Years
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Commercial Unique Component Manufacturer
R&D
PRODUCTION
END OF PROD
PRODUCTION LAG
Gov't System
SYSTEM ACQ PLANNING
BUDGET & FUNDING
PROG. SUPT. DEVEL
SYSTEM INTRO INTO SERVICE
IN SERVICE SUPT
Spares Acquisition
PROVISION PERIOD
INITIAL SPARES ACQ
Years
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

- Huge disconnect between IC design, development and test to the point where production parts are needed
- Production lag time can represent three or more generations of microelectronics technologies
- The "designed-in" technology is probably obsolete at production

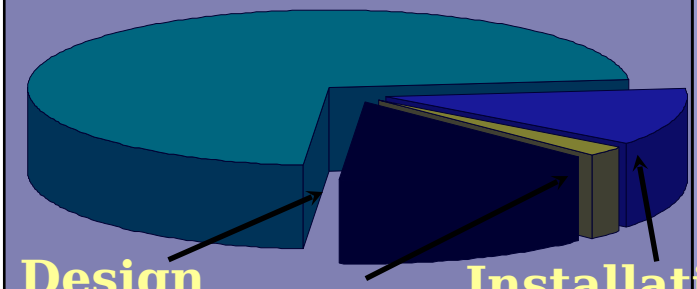
Weapon System Life Cycle



Life Cycle Cost Distribution

Acquisitions Costs 28%

Fabrication - 72%



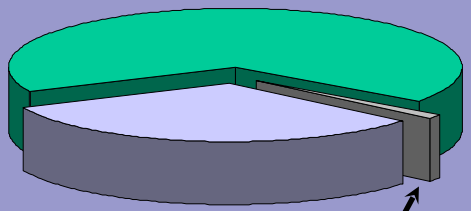
Design 12%

Documentation 2%

Installation Checkout 14%

Operations Cost 12%

Personnel - 67%



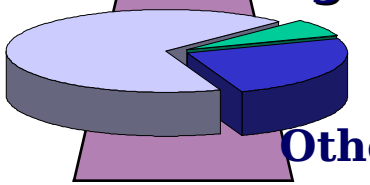
POL 32%

Misc 1%

Logistics Support Costs 60%

Investment Costs - 8%

Initial Training 7%



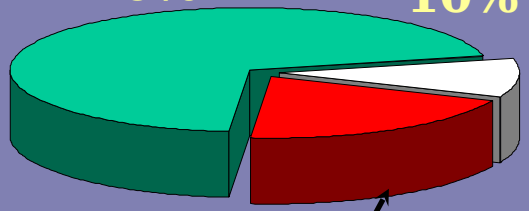
Initial Spares 68%

Other 25%

Recurring Support Cost 92%

Maint Labor 70%

Repair Materiel 10%



Replenish Spares - 20%

Source: Jeff Jones

DMSMS Stories

- F-22
  - DMS amounts to a $1B program throughout production
  - Parts availability life is approximately 2 to 5 years
  - Traditional “Build to Print” programs are no longer feasible
- AEGIS
  - Actively working DMSMS since 1992
  - Over 1000 DMSMS cases
  - Cost avoidance approaching $230M
- Patriot Missile
  - Single microcircuit: $2.1 million redesign, 24 months schedule slip
  - Unpackaged part was found
  - Cost and schedule impacts avoided

Govt. DMSMS Organizations

(Who are the players?)

- DMEA (DoD Executive Agent)
- DLA / DSCC
- GIDEP (DMSMS Database)
- Services' DMSMS Focal Points
  - Army
  - Air Force
  - Navy
- DoD DMSMS Working Group
- DoD DMSMS Teaming Group

Defense MicroElectronics Activity (DMEA)

- Authority:
  An OSD Organization under the authority, direction and control of DUSD(Logistics & Materiel Readiness)

- Mission:
  Develop strategic policies and solutions to address problems of microelectronic technology obsolescence and reduce the effects of DMSMS for the DoD.

- Reverse Engineering, Design, Prototype, Testing Facilities & Expertise

- Partnerships with Industry, Teaming Arrangements with the Services

- ARMS - Advanced Reconfigurable Manufacturing for Semiconductors:
  A true flexible foundry

DMEA – ARMS Facility

ARMS - Advanced Reconfigurable Manufacturing for Semiconductors

The product of a Government-Industry partnership to transfer commercial technology to DMEA through the licensing of intellectual property

Technologies Supported:

- 1.0 And 0.6 Micron CMOS
  - Multiple Arrays and Standard Cells
  - 1,000 to 500,000 Gates
  - Rad Hard
  - EEPROM Cells
- D.I. Rad Hard Bipolar
  - Multiple Arrays and Standard Cells
- Mixed Signal CMOS
- 5v and 3v Operation
- Fabrication, Package and Test
- 0.35 Micron CMOS

Application Types:

- Digital technologies
  - ASICs, Memories
  - Microprocessors
- Analog technologies
  - Op amps & VCOs
  - A/D converters
  - High voltage arrays
- Mixed signal technologies
  - A/D, Filters
  - Analog & digital combined
- Rad Hard/MCMs/Hybrids

Defense Supply Center, Columbus (DSCC)

Defense Supply Center, Columbus (DSCC) is a field activity of the DLA

DSCC Mission: To provide DOD with worldwide integrated supply chain solutions for land, air, and maritime weapon systems.

- Used by more than 24,000 military & civilian customers & 10,000 contractors as a supplier of weapons systems spare parts.
- Manages more than 1.7 million different items and accounts for more than $2 billion in annual sales.
- Was the first Inventory Control Point (ICP) in DLA to develop a weapons system approach toward materiel management.
- Is the Lead ICP for Land, Maritime and Missile weapons systems.
- DMSMS Program and GEM Program

DSCC – GEM (Generalized Emulation of Microcircuits)

- GEM provides a form, fit, and function replacement for non-available microcircuits using current design and processing technologies

- The current GEM contractor is Sarnoff Corporation (CAGE 0DKS7)
  - Sarnoff has a versatile system for emulation, utilizing a BiCMOS gate array technology for RTL, DTL, TTL, ECL, PMOS & CMOS pats.
  - Sarnoff has the capability to provide microcircuits compliant with paragraph 1.2.1 of MIL-STD-883, which includes SMDs

- Benefits of Emulation:
  - Elimination of costly circuit card or module redesign (typically $250K)
  - Audited reliability testing/screening
  - Indefinite availability of spares (once the emulation is completed)
  - Additional options for program managers to determine the best solution
  - Possible cost sharing arrangements within service activities and other military branches identified by DSCC
  - Avoid costly redesigns and save program $ for performance upgrades
  - For Government activities, delivery orders can be issued against an existing production contract
  - For OEMs, part orders can be placed directly with Sarnoff

Government-Industry Data Exchange Program (GIDEP)

- GIDEP is a cooperative activity between government and industry seeking to reduce or eliminate expenditures of resources by sharing technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment

- Since GIDEP's inception, participants have reported over $1 billion in prevention of unplanned expenditures

- Proper utilization of GIDEP data can materially improve the total quality & reliability of systems and components during acquisition and logistics phases & reduce costs in developing & manufacturing complex systems

- Services and tools available from GIDEP:
  - Weekly DMSMS Parts Listing
  - Weekly Pushed E-mail Distribution
  - Urgent Data Request (UDR)
  - Batch Match
  - Auto-Match/or Bill-of-Material (BOM) Monitor (per request only)
  - Parts Availability Forum

Services' DMSMS Focal Points (Case Resolution Guides)

- Each of the services has established a *DMSMS Case Resolution Guide*. The purpose of which is to provide assistance in both reactive and proactive DMSMS problem identification, analysis and resolution

- The individual services' Guides can be accessed by contacting:

AF : Air Force Materiel Command (AFRL/MLME)
James Neely (937) 904-4374 james.neely@ml.afrl.af.mil

Army: Army Materiel Command (AMCRDA-AI)
Luis Garcia-Baco (703) 617-8288 garcia-bacol@hqamc-exchg.army.mil

Navy: Naval Supply Systems Command (NAVSUP)
Jim Fitzgibbon (717) 605-1300 james_e_fitzgibbon@navsup.navy.mil

DoD DMSMS Working Group

- Ron Shimazu — DMEA/MED
  (916) 231-1508 — shimazu@dmea.osd.mil
- James Neely — Air Force Materiel Command (AFRL/MLME)
  (937) 904-4374 — james.neely@ml.afrl.af.mil
- Luis Garcia-Baco — Army Materiel Command (AMCRDA-AI)
  (703) 617-8288 — garcia-bacol@hqamc-exchg.army.mil
- Jim Fitzgibbon — Naval Supply Systems Command
  (717) 605-1300 — james_e_fitzgibbon@navsup.navy.mil
- John King — DLA (DLA J-338)
  (703) 767-1428 — john_king@hq.dla.mil
- David Robinson — DSCC (DLA-DSCC-CCP)
  (614) 692-7493 — david.robinson@dscc.dla.mil
- Jim Stein — GIDEP
  (703) 602-2165 — jstein@ar.navy.mil

DoD DMSMS Working Group

- Purpose
  - The DoD DMSMS Working Group is the DoD focal point for DMSMS initiatives for the Deputy Under Secretary of Defense (Logistics).
- Mission
  - The mission of the Working Group is to recommend management techniques, tools, and policies to increase readiness, sustain wartime operations, and reduce life-cycle costs of DoD weapon systems and materiel.
- Functions
  - Develop recommendations to DoD policy and procedures that will streamline regulations and practices to reduce DMSMS impacts and encourage aggressive and proactive management of DoD systems by both government and industry personnel.
  - Promote the utilization of DMSMS mgmt practices through education.
  - Coordinate DMSMS activities throughout government and industry to encourage leveraging efforts.

DMSMS
Government Participants

- Army AMCOM
- Army TACOM
- Army SBCCOM
- WSMR
- NUWC – Keyport
- NAVSEA – Crane
- USAF Aging Aircraft Program
- DCMA – Defense Contract Management Agency
- DLIS – Defense Logistics Info Service

DMSMS
Industry Participants

- ARINC
- Austin Semiconductor
- Aviparts
- Ball Systems Engineering
- Boeing
- Chelsea Technology, Inc.
- eComp (Electronic Components, Inc.)
- General Dynamics
- General Test Lab
- Georgia Tech Research Institute
- HTG Technologies
- IHS
- JMAR Semiconductor, Inc.
- Lansdale Semiconductor
- Lockheed Martin Corp.
- Manuflex
- Minco Technology Labs
- MTI
- Northrop Grumman
- NOW Electronics
- Raytheon Company
- Rochester Electroncis
- Sarnoff
- SEMELAB PLC
- Solid State Devices, Inc.
- Titan Systems Corporation

DoD DMSMS Teaming Group

- Promote Communications Among Programs
- Avoid High Cost of Redesign
- Share the Workload
- How it Works
  - Add your parts list to Teaming Database
  - A Case is Created When Two Programs Share the Need for an Obsolete Part
  - Share your case findings/resolutions at “Case Review”
  - No Foreign Visitors at “Case Review”

Teaming Group Representation

DoD DMSMS Steering Committee
Ron Shimazu – Chair
(916) 231-1508

DoD DMSMS Steering Committee
Dave Robinson – Deputy Chair
(614) 692-7493

Teaming Group Steering Committee

DoD DMSMS Teaming Group
Jack McDermott – Program Manager
(781) 377-6837

AIR FORCE

- AWACS
- B-1B
- B-2
- B-52
- C-17
- F-16
- JTIDS
- MILSTAR

ARMY

- M1A1 Tank
- M1A2 Tank
- MLRS
- Patriot Missile

NAVY

- AEGIS
- SPS-40, 48, 49
- SPS-55, 64, 67
- STANDARD Missile
- NAVAIR
- PAC-3
- SEAWOLF
- SQS-56
- SQQ-32
- VLS

DLA

- DSCC

Aftermarket Suppliers

- Lansdale
- Rochester Elec.

Conferences & Workshops

- DMSMS Conference
  - Held every 18 months
  - DUSD(L&MR) Sponsored
  - Co-hosted by DMEA & Alternating Service
  - 2002 Hosts – Army & DMEA

- DMSMS Workshops
  - Held every 9 months
  - Past discussion items
    - DMSMS Best Practices
    - Acquisition Guidelines
  - Audience Participation through Panel Sessions

Industry DMSMS Focal Points

- EIA (**E**lectronic **I**ndustries **A**lliance)
  - GEIA (**G**ovt. **E**lectronics and **I**nformation Technology **A**ssociation)
    - SSTC (**S**ystems, **S**tandards and **T**echnology **C**ouncil)
      - G-12 Solid State Devices Committee

        http://www.geia.org/sstc/G12

      - Avionics Process Management Committee (APMC)

        http://www.geia.org/sstc/APM

G-12
Solid State Devices Committee

Mission:

- Develops solutions to technical problems in the application, standardization, and reliability of solid state devices
- Evaluates and prepares recommendations for specifications, standards, & other documents, both government and industry, to assure suitability of solid state devices in their intended uses
- Holds three meetings a year in conjunction with JEDEC JC-13

DMSMS-Related Documents:

- SSB-1: Guidelines for Using Plastic Encapsulated Microcircuits and Semiconductors in Military, Aerospace and Other Rugged Applications
- GEB1: DMSMS Management Practices

DMSMS-Related Workshops:

- Lead-Free Solder
- Microcircuit Lower Operating Voltage

Avionics Process Management Committee

Background:

- Avionics OEMs expressed a desire to use common component management processes for all customers
- Avionics industry processes for “uprating” recognized as a need
- Originally known as Avionics Working Group (AWG) under IECQ

Mission:

- Develops process management standards for systems and equipment used in the field of avionics
- Acts as the US Technical Advisory Group for International Electrotechnical Committee 107, Process Mgmt for Avionics

Tasks:

- Electronic Component Management
- Extended Temperature Range (Uprating)
- Reliability Assessment

Defense Industry Activities

- Commercial Airlines DMSMS Activities (Boeing)
- Component Reliability Assessment Guidelines (GEIA)
- Design Guide for Satellite Parts (GEIA)
- DMSMS Best Practices (GEIA)
- Guidelines for Component Management Plans (GEIA)

Questions or Comments?